Claims

[c1] 1. A Magnetic Resonance Imaging (MRI) magnet field instability simulator comprising:
a rigid body motion generator simulating motions of one or more MRI system components;
an eddy current analyzer generating a magnetic stiffness and damping signal and an electromagnetic transfer function in response to said motions and a cryostat material properties signal;
a mechanical model generator generating a mechanical disturbance signal and a mechanical model of one or more MRI system components in response to said motions and said magnetic stiffness and damping signal;
a structural analyzer generating a motion signal in response to said mechanical model; and
a field instability calculator generating a field instability signal in response to said electromagnetic transfer function and said motion signal.

[c2] 2. A simulator as in claim 1 wherein said mechanical disturbance signal comprises at least one of an internal mechanical disturbance signal and an external mechanical disturbance signal.

[c3] 3. A simulator as in claim 2 wherein said mechanical disturbance signal comprises information corresponding to at least one of cryostat motion, coil motion, magnet motion, and environmental motion.

[c4] 4. A simulator as in claim 1 wherein said motion signal comprises information corresponding to at least one of cryostat motion, coil motion, magnet motion, and environmental motion.

[c5] 5. A simulator as in claim 1 wherein said mechanical model comprises at least one of magnet geometry, material properties, boundary conditions, and magnet stiffness and damping.

[c6] 6. A simulator as in claim 1 wherein said structural analyzer converts nodal displacements into rigid body motions.

[c7] 7. A simulator as in claim 6 wherein said field instability calculator multiplies

said rigid body motions by said electromagnetic transfer function to produce said field instability signal.

[c8] 8. A simulator as in claim 1 wherein said field instability signal comprises a frequency distribution of field disturbances.

[c9] 9. A method of simulating and determining field instability within a MRI system comprising:
simulating motions of one or more MRI system components;
generating a magnetic stiffness and damping signal and an electromagnetic transfer function in response to said motions and a cryostat material properties signal;
generating a mechanical disturbance signal and a mechanical model of one or more MRI system components in response to said motions and said magnetic stiffness and damping signal;
generating a motion signal in response to said mechanical model; and
generating a field instability signal in response to said electromagnetic transfer function and said motion signal.

[c10] 10. A method as in claim 9 wherein generating an electromagnetic transfer function comprises performing an eddy current analysis.

[c11] 11. A method as in 9 wherein generating a motion signal comprises performing a structural analysis of one or more MRI system components.

[c12] 12. A method as in claim 11 wherein performing a structural analysis comprises converting nodal displacements into rigid body motions.

[c13] 13. A method as in claim 9 wherein generating said field instability signal comprises multiplying said mechanical disturbance signal by said electromagnetic transfer function.

[c14] 14. A method as in claim 9 further comprising frequency sweeping said field instability signal to obtain a desired frequency operating range.

[c15] 15. A method as in claim 9 further comprising modifying at least one MRI system feature to adjust one or more resulting frequency magnitudes.

[c16] 16. A method as in claim 9 further comprising modifying at least one MRI system feature to adjust a resulting frequency operating band to be approximately within a desired frequency operating range.

[c17] 17. A method as in claim 9 further comprising balancing a resulting eddy current with a resulting amount of MRI system component movement in response to said field instability signal.

[c18] 18. A method as in claim 9 further comprising modifying a cryostat or cryostat support material in response to said field instability signal.

[c19] 19. A method of simulating and determining field instability within a MRI system comprising:
simulating motions of one or more MRI system components;
generating a magnetic stiffness and damping signal and an electromagnetic transfer function in response to said motions and a cryostat material properties signal;
generating a mechanical disturbance signal and a mechanical model of one or more MRI system components in response to said motions and said magnetic stiffness and damping signal;
generating a motion signal in response to said mechanical model;
generating a field instability signal in response to said electromagnetic transfer function and said motion signal;
frequency sweeping said field instability signal to obtain a desired frequency operating range; and
modifying a MRI system component to adjust said field instability signal comprising a resulting frequency operating band, to be in said desired frequency operating range.

[c20] 20. A method as in claim 19 further comprising:
balancing a resulting eddy current with a resulting amount of MRI system component movement in response to said field instability signal to determine desired cryostat materials; and
modifying a cryostat or cryostat support material to reflect said desired cryostat materials.